operated animals made up the experimental group and the control group, respectively (n=7/each group). Paraffin embedded 5-μm thick sagittal sections in the medial midcondylar region of the knee were made.

Histology and measurements. The sections were stained with Elastica Masson-Goldner's methods. Histological changes in the anterior and posterior synovial membrane, and capsule were separately observed. The length of the synovial membrane (antero-superior, antero-inferior, postero-superior, and postero-inferior), which was defined as two to three-layered cells of superficial zone in the capsule, was separately measured. The outside length of the posterior capsule and the area of the anterior and posterior capsule were also measured (Figure 1).

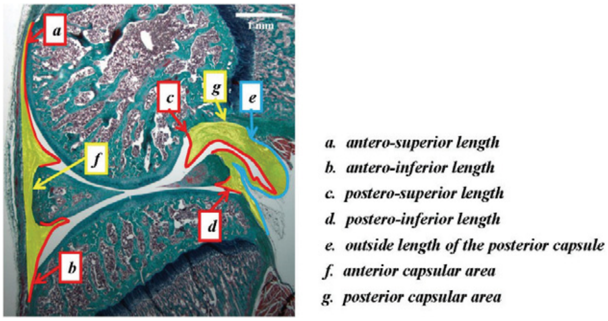

Figure 1

Results: *Morphological changes.* There were no morphological changes in the control group through the experimental periods. After 2 weeks of immobilization, adhesions between the postero-superior synovial fold and the synovial membrane around the posterior horn of the medial meniscus were observed. The adhesion areas extended posteriorly after 4 weeks of immobilization, and the joint space was replaced by loose connective tissue after 8 and 16 weeks of immobilization (Figure 2). Anterior synovial membrane also showed adhesions of the synovial membrane to the meniscus and the articular cartilage after 2 weeks of immobilization.

*Morphometric changes:*There were no significant differences in the length of the antero-superior synovial membrane. The length of the antero-inferior synovial membrane was significantly decreased after 4 weeks in the experimental group. The lengths of the postero-superior and postero-inferior synovial membrane were significantly decreased after 2 weeks in the experimental group. The length of the postero-superior synovial membrane gradually decreased due to the replacement of the joint space into loose connective tissue. The outside length of the posterior capsule was

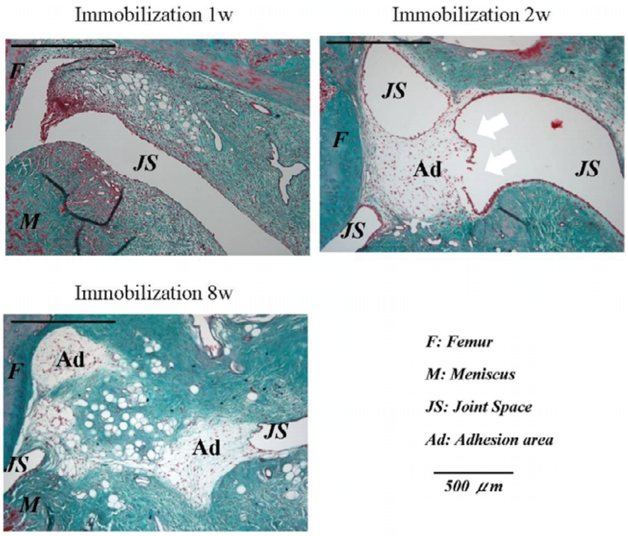

Figure 2

also significantly decreased after 8 weeks in the experimental group (Figure 3). No significant differences were found in the area of the anterior and posterior capsule, though adhesions were observed after 2 weeks of immobilization.

Conclusions: Decrease in the length of the synovial membrane might suggest decrease of the joint cavity. Decrease in the outside length of the posterior capsule might indicate that capsular adhesion had occurred, which caused limitation in extension. Joint immobilization induced morphological and morphometric changes of the synovial membrane as well as the capsule.

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MENISCUS SHAPE, POSITION, AND SIGNAL UNDER SIMULATED WEIGHTBEARING AND NON-WEIGHTBEARING CONDITIONS IN VIVO

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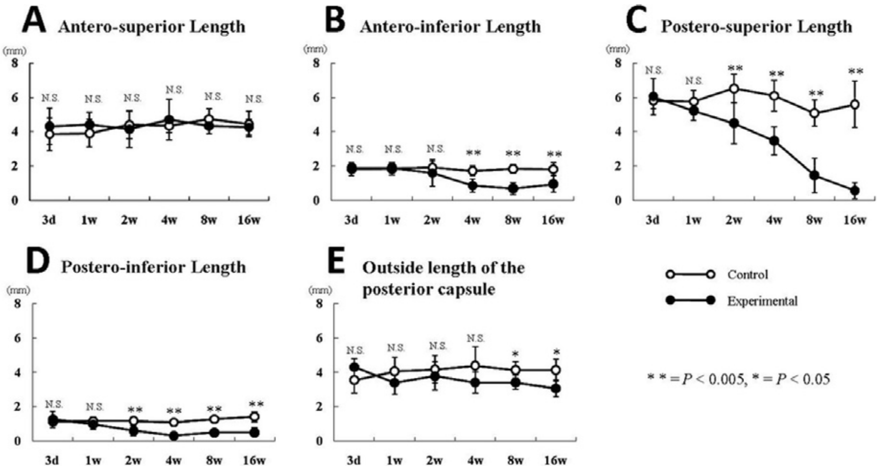
Purpose: Meniscal pathology (extrusion, tears) was associated



Abstract 442 – Figure 3

with progression and cartilage loss in OA using MRI. Studies have been performed under non-weight-bearing (NWB) conditions, and little is known about alterations of the meniscus under weight-bearing (WB) conditions. It has also been suggested that meniscal extrusion may cause joint space narrowing (JSN) in WB radiographs, but radiography is unable to delineate the meniscus directly. The purpose of this study was therefore to use MRI to investigate the impact of WB conditions on the shape, position and signal of the medial meniscus (MM).

Methods: One knee in each of 26 women (age 55±5.6 years; BMI 27.9±2.3 kg/m^2) was studied; 9 were healthy (Kellgren Lawrence grade [KLG] 0) and 17 had radiographic evidence of OA (10 KLG 2; 7 KLG 3). 3 Tesla MR images were acquired using a T2-weighted fat-suppressed coronal FSE sequence (2×0.31×0.31 mm). Images were acquired with the participant supine, first under NWB and then under simulated WB conditions, applying a force of 50% body weight to the lower extremities. Manual segmentation of the tibial, femoral and external surfaces of MM, and of the tibial joint surface area was performed by one reader (RF) and quality controlled by another (FE). Both readers were blinded to KLG and WB/NWB status. Measures were computed for the entire MM and for the anterior/posterior horns and the middle portion, using custom software (Chondrometrics GmbH, Ainring, Germany). Differences between WB and NWB conditions were assessed using the Wilcoxon signed rank test, and differences (in differences between WB and NBW) between OA and healthy knees using the Mann Whitney U-test.

Results: There was no significant difference in the volume (p=0.89) and mean or maximal thickness (p=0.81/p=0.09) of the whole MM between WB and NWB. The external surface, however, displayed increased bulging under WB (median 0.30 vs. 0.25 mm; p=0.03). In the middle portion of MM, the maximal thickness INcreased from 6.8 to 7.3 mm (p=0.02) and the bulging was 0.31 vs. 0.23 mm (p=0.01) under WB. Extrusion significantly increased under WB: the tibial area covered by MM decreased from 38% to 36% ($p<0.001$), the external MM surface was located 2.31 vs. 2.00 mm medial to the margin of the tibial surface (p=0.01), and the intersection of the tibial and femoral MM surface was located 3.5 mm vs. 3.9 mm lateral to the margin of the tibial surface (p=0.006). In the middle portion, the position of the external MM surface was 2.47 vs. 2.02 mm medial to the margin of the tibial surface (p=0.002). The signal intensity of the entire meniscus increased under WB conditions (p=0.001). This was also observed in the anterior/posterior horns and in the middle portion of the MM ($p\leq0.001$). Differences in extrusion between WB and NWB were greater in OA than in healthy knees (p=0.034 for location of the external MM surface).

Conclusions: In this first quantitative in vivo study we find that MM extrusion significantly increased under WB conditions; differences between WB and NWB conditions were stronger in OA versus healthy knees. The signal in the MM also significantly increased under WB, potentially due to alterations in collagen structure. However, the volume and mean thickness of MM did not differ between WB and NWB. Surprisingly, the maximal thickness of the middle portion (measured at the external margin of MM) significantly increased during WB. Futures studies will look at the relative contribution of meniscal extrusion and cartilage deformation to JSN.

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CLINICAL AND ULTRASONOGRAPHIC PREDICTORS OF JOINT REPLACEMENT FOR KNEE OSTEOARTHRITIS: RESULTS FROM A LARGE, 5 YEARS, PROSPECTIVE EULAR STUDY

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Purpose: To determine clinical and ultrasonographic predictors of joint replacement surgery across Europe in primary osteoarthritis (OA) of the knee.

Methods: This was a 5-year prospective study of a painful OA knee cohort (from a EULAR-sponsored, multi-center study). All subjects had clinical evaluation, radiographs and ultrasonography (US) at study entry. The rate of knee replacement surgery over the 5-year follow-up period was determined using Kaplan-Meier survival data analyses. Predictive factors for joint replacement were identified by univariate Log-rank test then multivariate analysis using a Cox proportional-hazards regression model. Potential baseline predictors included demographic, clinical, radiographic and US features.

Results: Of the 600 original patients, 531 (88.5%), mean age 67±10 years, mean disease duration 6.1±6.9 years had follow-up data and were analyzed. During follow-up, knee replacement was done or required for 131 patients (survival rate estimation of 72.2%). By multivariate analysis, predictors of articular replacement were: Kellgren & Lawrence radiographic grade (grade ≥ III-IV versus < III, Hazards Ratio (HR) = 3.00 [95% CI = 1.91-4.70], $p<0.0001$); ultrasonographic knee effusion or ultrasonographic knee synovitis (ultrasonographic knee effusion depth or ultrasonographic knee synovitis versus none, HR = 2.51 [95% CI = 1.69-3.74], $p<0.0001$); WOMAC pain subscale (≥ 50 versus <50, HR = 1.77 [95% CI = 1.18-2.67], p=0.0058); and disease duration (≥ 5 years versus <5 yrs, HR= 1.76 [95% CI=1.20-2.58], p=0.0039).

Conclusions: Longitudinal evaluation of this OA cohort demonstrated significant progression to joint replacement. In addition to severity of radiographic damage and pain, US detected effusion or US synovitis were a predictor of subsequent joint replacement.

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THE EFFECTS OF THIRD METACARPAL GEOMETRY ON THE INCIDENCE OF CONDYLAR FRACTURES IN THOROUGHBRED RACEHORSES

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Purpose: The objective of this study was to determine the influence of third metacarpal surface geometry on third metacarpal condylar fracture in Thoroughbred racehorses.

Methods: Computed tomographic scans of horses with condylar fractures (n=51, FX) the contralateral limbs of the same horses (n=51, NFX) and non-fractured horses (n=80, CTL) were made. The images were rendered into three dimensional image of the condylar surface in order to characterize condylar width, condylar